Table of contents

1 Introduction 21
1.1 Overview of the S7-1200 automation system 21
1.1.1 SIMATIC S7-1200 22
1.1.2 Overview of STEP 7 Basic 24
1.1.3 Three programming languages 25
1.1.4 Execution of the user program 27
1.1.5 Data management in the SIMATIC automation system 29
1.1.6 Operator control and monitoring with process images 30
1.2 Introduction to STEP 7 Basic for S7-1200 31
1.2.1 Installing STEP 7 31
1.2.2 Automation License Manager 31
1.2.3 Starting STEP 7 Basic 32
1.2.4 Portal view 32
1.2.5 Help Information system 33
1.2.6 The windows of the project view 34
1.2.7 Adapting the user interface 36
1.3 Editing a SIMATIC project 37
1.3.1 Structured representation of project data 38
1.3.2 Project data and editors for a PLC station 39
1.3.3 Creating and editing a project 41
1.3.4 Creating and editing libraries 42

2 SIMATIC S7-1200 automation system 43
2.1 S7-1200 station components 43
2.2 S7-1200 CPU modules 44
2.2.1 Integrated I/O 44
2.2.2 PROFINET connection 46
2.2.3 Status LEDs 47
2.2.4 SIMATIC Memory Card 47
2.2.5 Expansions of the CPU 47
2.3 Signal modules (SM) 49
2.3.1 Digital I/O modules 49
2.3.2 Analog input/output modules 50
2.3.3 Properties of the I/O connections 50
2.4 Communication modules (CM) 52
2.4.1 Point-to-point communication 52
2.4.2 PROFIBUS DP 52
2.4.3 Actuator/sensor interface 53
2.4.4 GPRS transmission 53
2.5 Further modules 54
2.5.1 Compact switch module (CSM) 54

2.5.2 Power module (PM) 54
2.5.3 TS Adapter IE Basic 54
2.5.4 SIM 1274 simulator 55
2.6 SIPLUS S7-1200 55

3 Device configuration 57
3.1 Introduction 57
3.2 Configuring a station 60
3.2.1 Adding a PLC station 60
3.2.2 Arranging modules 61
3.2.3 Adding an HMI station 61
3.3 Assigning module parameters 61
3.3.1 Parameterization of CPU properties 61
3.3.2 Addressing input and output signals 64
3.3.3 Parameterization of digital inputs 65
3.3.4 Parameterization of digital outputs 65
3.3.5 Parameterization of analog inputs 66
3.3.6 Parameterization of analog outputs 66
3.4 Configuring the network 67
3.4.1 Introduction 67
3.4.2 Networking stations 68
3.4.3 Node addresses in a subnet 69
3.4.4 Connectors 70
3.4.5 Configuring a PROFINET subnet 73
3.4.6 Configuring a PROFIBUS subnet 75
3.4.7 Configuring an AS-i subnet 77

4 Variables and data types 79
4.1 Operands and tags 79
4.1.1 Introduction, overview 79
4.1.2 Operand areas: inputs and outputs 80
4.1.3 Operand area bit memory 82
4.1.4 Operand area data 84
4.1.5 Operand area temporary local data 85
4.2 Addressing 85
4.2.1 Signal path 85
4.2.2 Absolute addressing of an operand 86
4.2.3 Absolute addressing of an operand area 86
4.2.4 Symbolic addressing 88
4.2.5 Addressing a tag part 89
4.2.6 Addressing constants 89
4.2.7 Indirect addressing 89
4.3 General information on data types 92
4.3.1 Overview of data types 92
4.3.2 Implicit data type conversion 93
4.3.3 Overlaying tags (data type views) 93
4.4 Elementary data types 95
4.4.1 Bit-serial data types BOOL, BYTE, WORD and DWORD 95

4.4.2 BCD-coded numbers BCD16 and BCD32 ... 95
4.4.3 Unsigned fixed-point data types USINT, UINT and UDINT ... 97
4.4.4 Fixed-point data types with sign SINT, INT and DINT ... 98
4.4.5 Floating-point data types REAL and LREAL ... 98
4.4.6 Data type CHAR ... 100
4.4.7 Data type DATE ... 100
4.4.8 Data type TIME ... 100
4.4.9 TIME_OF_DAY (TOD) data type ... 101
4.5 Structured data types ... 101
4.5.1 Data type DTL ... 101
4.5.2 Data type STRING ... 102
4.5.3 Data type ARRAY ... 104
4.5.4 Data type STRUCT ... 104
4.6 Parameter types ... 107
4.6.1 Parameter types for IEC timer functions ... 107
4.6.2 Parameter types for IEC counter functions ... 108
4.6.3 Parameter type VARIANT ... 108
4.6.4 Parameter type VOID ... 109
4.7 PLC data types ... 109
4.8 System data types ... 110
4.8.1 IEC_TIMER system data type ... 110
4.8.2 IEC_COUNTER system data type ... 112
4.8.3 TCON_Param data type ... 112
4.8.4 TADDR_Param data type ... 112
4.8.5 Data type ErrorStruct ... 112
4.8.6 TimeTransformationRule data type ... 115
4.9 Hardware data types ... 115

5 Edit user program ... 117
5.1 Operating modes ... 117
5.1.1 STOP mode ... 118
5.1.2 STARTUP mode ... 118
5.1.3 RUN mode ... 119
5.1.4 Retentive behavior of operands ... 121
5.2 Creating a user program ... 122
5.2.1 Program draft ... 122
5.2.2 Program execution ... 123
5.2.3 Nesting depth ... 125
5.3 Programming blocks ... 125
5.3.1 Block types ... 125
5.3.2 Editing block properties ... 128
5.3.3 Configuring know-how protection ... 132
5.3.4 Copy protection ... 132
5.3.5 Block interface ... 133
5.3.6 Programming block parameters ... 136
5.4 Calling blocks ... 137
5.4.1 General information on calling logic blocks ... 137
5.4.2 Calling a function (FC) ... 139

5.4.3 Calling a function block (FB) ... 140
5.4.4 "Passing on" of block parameters ... 142
5.5 Start-up routine ... 142
5.6 Main program ... 143
5.6.1 Organization blocks for the main program ... 143
5.6.2 Process image update ... 143
5.6.3 Cycle time ... 144
5.6.4 Reaction time ... 146
5.6.5 Stop program execution ... 147
5.6.6 Time ... 148
5.6.7 Runtime meter ... 151
5.7 Interrupt processing ... 153
5.7.1 Introduction to interrupt processing ... 153
5.7.2 Time-delay interrupts ... 155
5.7.3 Cyclic interrupts ... 159
5.7.4 Process interrupts ... 163
5.7.5 Assigning interrupts during runtime ... 164
5.7.6 Delay and enable interrupts ... 166
5.8 Troubleshooting, diagnostics ... 167
5.8.1 Causes of errors and responses ... 167
5.8.2 Error display with the ENO output ... 168
5.8.3 Time error OB 80 ... 168
5.8.4 Local error handling ... 169
5.8.5 Diagnostic functions in the user program ... 172
5.8.6 Diagnostics interrupt OB 82 ... 176

6 Program editor ... 178
6.1 Introduction ... 178
6.2 PLC tag table ... 178
6.2.1 Creating and editing the PLC tag table ... 179
6.2.2 Defining PLC tags ... 179
6.2.3 Editing a PLC tag table ... 181
6.2.4 Exporting and importing a PLC tag table ... 181
6.2.5 Constants tables ... 182
6.3 Programming a code block ... 183
6.3.1 Creating a new code block ... 183
6.3.2 Working area of program editor for code blocks ... 184
6.3.3 Specifying code block properties ... 186
6.3.4 Programming a block interface ... 186
6.3.5 Programming control functions ... 188
6.3.6 Editing tags ... 192
6.3.7 Working with program comments ... 193
6.4 Programming a data block ... 194
6.4.1 Creating a new data block ... 194
6.4.2 Working area of program editor for data blocks ... 195
6.4.3 Defining properties for data blocks ... 196
6.4.4 Declaring data tags ... 196
6.4.5 Entering data tags in global data blocks ... 198

6.5 Compiling blocks ... 198
6.5.1 Starting the compilation ... 198
6.5.2 Compiling SCL blocks ... 199
6.5.3 Eliminating errors following compilation ... 200
6.6 Program information ... 201
6.6.1 Cross-reference list ... 201
6.6.2 Assignment list ... 203
6.6.3 Call structure ... 204
6.6.4 Dependency structure ... 205
6.6.5 Consistency check ... 206
6.6.6 CPU resources ... 206
6.7 Language setting ... 207

7 Ladder logic LAD ... 209
7.1 Introduction ... 209
7.1.1 Programming with LAD in general ... 209
7.1.2 Program elements of ladder logic ... 211
7.2 Programming with contacts ... 212
7.2.1 NO and NC contacts ... 212
7.2.2 Consideration of sensor type in ladder logic ... 213
7.2.3 Series connection of contacts ... 215
7.2.4 Parallel connection of contacts ... 215
7.2.5 Mixed series and parallel connections ... 216
7.2.6 T branch, open parallel branch in the ladder logic ... 217
7.2.7 Negating result of logic operation in the ladder logic ... 218
7.2.8 Edge evaluation of a binary tag in ladder logic ... 218
7.2.9 OK contact ... 219
7.2.10 Comparison contacts ... 219
7.3 Programming with coils ... 221
7.3.1 Simple and negated coils ... 222
7.3.2 Set and reset coil ... 223
7.3.3 Retentive response due to latching ... 223
7.3.4 Edge evaluation with pulse output in the ladder logic ... 224
7.3.5 Multiple setting and resetting (filling of bit field) in the ladder logic ... 225
7.3.6 Starting IEC timer functions in the ladder logic with coils ... 225
7.4 Programming with Q boxes in the ladder logic ... 226
7.4.1 Arrangement of Q boxes in the ladder logic ... 226
7.4.2 Memory boxes in the ladder logic ... 227
7.4.3 Edge evaluation of current flow ... 229
7.4.4 Example of binary scaler in the ladder logic ... 229
7.4.5 Controlling IEC timer functions in the ladder logic with Q boxes ... 230
7.4.6 Controlling IEC counter functions in the ladder logic with Q boxes ... 231
7.5 Programming with EN/ENO boxes in the ladder logic ... 233
7.5.1 Positioning of EN/ENO boxes in the ladder logic ... 234
7.5.2 Transfer functions in the ladder logic ... 235
7.5.3 Arithmetic functions for numerical values in the ladder logic ... 236
7.5.4 Arithmetic functions for time values in the ladder logic ... 236
7.5.5 Math functions in the ladder logic ... 237

7.5.6 Conversion functions in the ladder logic ... 238
7.5.7 Shift functions in the ladder logic ... 239
7.5.8 Logic functions in the ladder logic ... 240
7.5.9 Functions for strings in the ladder logic ... 240
7.6 Functions for program flow control (LAD) ... 241
7.6.1 Jump functions in the ladder logic ... 242
7.6.2 Jump list in the ladder logic ... 243
7.6.3 Jump distributor in the ladder logic ... 244
7.6.4 Block end function in the ladder logic ... 244
7.6.5 Block call functions in the ladder logic ... 245

8 Function block diagram FBD ... 246
8.1 Introduction ... 246
8.1.1 Programming with function block diagram in general ... 246
8.1.2 Program elements of the function block diagram ... 248
8.2 Programming of binary logic operations (FBD) ... 249
8.2.1 Scanning for signal states "1" and "0" ... 250
8.2.2 Taking account of the sensor type in the function block diagram ... 251
8.2.3 AND function ... 252
8.2.4 OR function ... 253
8.2.5 Exclusive OR function ... 254
8.2.6 Mixed binary logic operations ... 254
8.2.7 T branch in the function block diagram ... 255
8.2.8 Negate result of logic operation in the function block diagram ... 255
8.2.9 Edge evaluation of binary tags in the function block diagram ... 256
8.2.10 Validity checking of floating-point numbers in the function block diagram ... 257
8.2.11 Comparison functions in the function block diagram ... 258
8.3 Programming with standard boxes (FBD) ... 258
8.3.1 Assignment and negated assignment ... 259
8.3.2 Set and reset boxes ... 260
8.3.3 Edge evaluation with pulse output in the function block diagram ... 261
8.3.4 Multiple setting and resetting (filling of bit field) in the function block diagram ... 262
8.3.5 Starting IEC timer functions in the function block diagram with standard boxes ... 262
8.4 Programming with Q boxes (FBD) ... 264
8.4.1 Arrangement of Q boxes in the function block diagram ... 264
8.4.2 Memory boxes in the function block diagram ... 265
8.4.3 Edge evaluation of logic operation result in the function block diagram ... 266
8.4.4 Example of binary scaler in the function block diagram ... 267
8.4.5 Controlling IEC timer functions in the function block diagram with Q boxes ... 267
8.4.6 IEC counter functions in the function block diagram ... 268
8.5 Programming with EN/ENO boxes (FBD) ... 270
8.5.1 Positioning of EN/ENO boxes in the function block diagram ... 270
8.5.2 Transfer functions in the function block diagram ... 271

8.5.3 Arithmetic functions for numerical values in the function block diagram ... 273
8.5.4 Arithmetic functions with time values in the function block diagram ... 273
8.5.5 Math functions in the function block diagram ... 274
8.5.6 Conversion functions in the function block diagram ... 275
8.5.7 Shift functions in the function block diagram ... 276
8.5.8 Logic functions in the function block diagram ... 277
8.5.9 Functions for strings in the function block diagram ... 278
8.6 Functions for program flow control (FBD) ... 279
8.6.1 Jump functions in the function block diagram ... 280
8.6.2 Jump list in the function block diagram ... 281
8.6.3 Jump distributor in the function block diagram ... 281
8.6.4 Block end function in the function block diagram ... 282
8.6.5 Block call functions in the function block diagram ... 282

9 Structured Control Language SCL ... 284
9.1 Introduction to programming with SCL ... 284
9.1.1 Programming with SCL in general ... 284
9.1.2 SCL statements and operators ... 286
9.2 Programming binary logic operations with SCL ... 288
9.2.1 Scanning for signal states "1" and "0" ... 288
9.2.2 Taking account of the sensor type for SCL ... 289
9.2.3 AND function ... 291
9.2.4 OR function ... 291
9.2.5 Exclusive OR function ... 292
9.2.6 Combined binary logic operations ... 292
9.2.7 Negating the result of logic operation ... 293
9.3 Programming memory functions with SCL ... 294
9.3.1 Value assignment of a binary tag ... 294
9.3.2 Setting and resetting ... 294
9.3.3 Edge evaluation ... 295
9.4 Programming timer and counter functions with SCL ... 296
9.4.1 IEC timer functions ... 296
9.4.2 IEC counter functions ... 297
9.5 Programming digital functions with SCL ... 298
9.5.1 Transfer function, value assignment of a digital tag ... 298
9.5.2 Conversion functions ... 299
9.5.3 Comparison functions ... 301
9.5.4 Arithmetic functions ... 301
9.5.5 Mathematical functions ... 303
9.5.6 Word logic operations ... 303
9.5.7 Shift functions ... 304
9.6 Controlling the program flow with SCL ... 305
9.6.1 Working with the ENO tag ... 305
9.6.2 EN/ENO mechanism with SCL ... 306
9.6.3 Control statements ... 307
9.6.4 Block functions ... 316
9.7 Working with source files ... 319

9.7.1 General procedure ... 319
9.7.2 Programming a logic block in the source file ... 321
9.7.3 Programming a data block in the source file ... 325
9.7.4 Programming a PLC data type in the source file ... 327

10 Basic functions ... 328
10.1 Binary logic operations ... 328
10.1.1 Introduction ... 328
10.1.2 Scanning for signal states "1" and "0", result of the scan ... 329
10.1.3 Negating the result of the logic operation, NOT contact ... 329
10.1.4 Testing floating-point tag, OK contact, OK box ... 330
10.1.5 AND function, series connection ... 331
10.1.6 OR function, parallel connection ... 332
10.1.7 Exclusive OR function, non-equivalence function ... 333
10.2 Memory functions ... 334
10.2.1 Introduction ... 334
10.2.2 Simple and negated coil, assignment ... 334
10.2.3 Single set and reset ... 335
10.2.4 Multiple setting and resetting ... 336
10.2.5 Dominant setting and resetting, memory boxes ... 337
10.3 Edge evaluation ... 338
10.3.1 Functional principle of an edge evaluation ... 338
10.3.2 Edge evaluation of the result of the logic operation ... 340
10.3.3 Edge evaluation of a binary tag ... 341
10.3.4 Edge evaluation with pulse output ... 342
10.4 Time functions ... 344
10.4.1 Introduction ... 344
10.4.2 Pulse generation TP ... 346
10.4.3 On-delay TON ... 347
10.4.4 OFF delay TOF ... 347
10.4.5 Accumulating ON delay TONR ... 348
10.5 Counter functions ... 349
10.5.1 Introduction ... 349
10.5.2 Up counter CTU ... 351
10.5.3 Down counter CTD ... 352
10.5.4 Up-down counter CTUD ... 353

11 Digital functions ... 355
11.1 Transfer functions ... 356
11.1.1 Introduction ... 356
11.1.2 Copy tag, MOVE box for LAD and FBD ... 356
11.1.3 Copy string, S_MOVE box for LAD and FBD ... 357
11.1.4 Value assignments with SCL ... 358
11.1.5 Copy data area (MOVE_BLK, UMOVE_BLK) ... 360
11.1.6 Filling the data area (FILL_BLK, UFILL_BLK) ... 361
11.1.7 Read and write the load memory (READ_DBL, WRIT_DBL) ... 362
11.1.8 Swap bytes (SWAP) ... 363
11.2 Comparison functions ... 364

11.2.1 Overview ... 364
11.2.2 Comparison of two tag values ... 364
11.2.3 Range comparison ... 365
11.3 Arithmetic functions for numerical values ... 366
11.3.1 Introduction ... 366
11.3.2 Addition ADD ... 367
11.3.3 Subtraction SUB ... 367
11.3.4 Multiplication MUL ... 367
11.3.5 Division DIV ... 367
11.3.6 Division with remainder as result MOD ... 368
11.3.7 Generation of absolute value ABS ... 368
11.3.8 Negation NEG ... 369
11.3.9 Decrement DEC, increment INC ... 369
11.4 Arithmetic functions for time values ... 369
11.4.1 Introduction ... 369
11.4.2 Addition T_ADD ... 371
11.4.3 Subtraction T_SUB ... 371
11.4.4 Difference T_DIFF ... 371
11.4.5 Combine T_COMBINE ... 371
11.5 Mathematical functions ... 372
11.5.1 Introduction ... 372
11.5.2 Trigonometric functions SIN, COS, TAN ... 373
11.5.3 Arc functions ASIN, ACOS, ATAN ... 373
11.5.4 Formation of square SQR ... 374
11.5.5 Extraction of square root SQRT ... 374
11.5.6 Exponentiate to base e EXP ... 374
11.5.7 Calculation of Napierian logarithm LN ... 374
11.5.8 Extracting decimal places FRAC ... 375
11.5.9 Exponentiation to any base EXPT ... 375
11.6 Conversion functions (Conversion of data type) ... 376
11.6.1 Introduction ... 376
11.6.2 Conversion function CONV ... 377
11.6.3 Conversion functions for floating-point numbers ... 378
11.6.4 Conversion functions SCALE_X and NORM_X ... 381
11.6.5 Conversion function T_CONV ... 383
11.6.6 Conversion function S_CONV ... 383
11.6.7 Conversion functions STRG_VAL and VAL_STRG ... 385
11.6.8 Conversion functions STRG_TO_CHARS and CHARS_TO_STRG ... 387
11.6.9 Conversion functions ATH and HTA ... 389
11.7 Shift functions ... 389
11.7.1 Introduction ... 389
11.7.2 Shift to right (SHR) ... 389
11.7.3 Shift to left (SHL) ... 391
11.7.4 Rotate to right (ROR) ... 391
11.7.5 Rotate to left (ROL) ... 392
11.8 Logic functions ... 392
11.8.1 Introduction ... 392
11.8.2 Word logic operations (AND, OR, XOR) ... 392
11.8.3 Invert (INV) ... 394

11.8.4 Coding functions DECO and ENCO ... 394
11.8.5 Selection functions SEL, MUX, and DEMUX ... 395
11.8.6 Minimum selection MIN, Maximum selection MAX ... 397
11.8.7 Limiter LIMIT ... 398
11.9 Processing of strings (Data type STRING) ... 398
11.9.1 Output length of a string LEN ... 399
11.9.2 Combine strings CONCAT ... 400
11.9.3 Output left part of string LEFT ... 400
11.9.4 Output right part of string RIGHT ... 401
11.9.5 Output middle part of string MID ... 401
11.9.6 Delete part of a string DELETE ... 401
11.9.7 Insert string INSERT ... 402
11.9.8 Replace part of string REPLACE ... 403
11.9.9 Find part of string FIND ... 403
11.10 Calculating with the CALCULATE box in LAD and FBD ... 404

12 Program flow control ... 406
12.1 Jump functions ... 406
12.1.1 Overview ... 406
12.1.2 Absolute jump ... 407
12.1.3 Conditional jump ... 408
12.1.4 Jump list JMP_LIST ... 409
12.1.5 Jump distributor SWITCH ... 410
12.2 Block end function ... 412
12.3 Calling of code blocks ... 413
12.3.1 Introduction ... 413
12.3.2 Calling a function FC ... 413
12.3.3 Calling a function block (FB) ... 415
12.4 EN/ENO mechanism ... 417
12.4.1 EN/ENO mechanism with LAD and FBD ... 418
12.4.2 EN/ENO mechanism with SCL ... 418
12.4.3 EN/ENO for user blocks ... 419

13 Online operation, diagnostics and debugging ... 420
13.1 Connecting a programming device to the PLC station ... 421
13.1.1 IP addresses of the programming device ... 421
13.1.2 Connecting the programming device to the PLC station ... 422
13.1.3 Assigning an IP address to the CPU module ... 424
13.1.4 Switching on the online mode ... 424
13.2 Transferring project data ... 425
13.2.1 Loading project data for the first time ... 425
13.2.2 Delta downloading of project data ... 427
13.2.3 Error message following downloading ... 428
13.2.4 Working with the memory card ... 428
13.2.5 Processing blocks offline/online ... 431
13.2.6 Comparing blocks offline/online ... 432
13.2.7 Editing online project without offline project ... 433
13.2.8 Uploading project data from the CPU ... 434

13.3 Hardware diagnostics 436
13.3.1 Status displays on the modules 436
13.3.2 Diagnostics information 437
13.3.3 Diagnostics buffer 437
13.3.4 Diagnostics functions 439
13.3.5 Online tools 439
13.3.6 Further diagnostics information via the programming device 440
13.4 Testing the user program 441
13.4.1 Introduction to testing with program status 441
13.4.2 Program status with LAD and FBD 442
13.4.3 Program status in SCL 444
13.4.4 Monitoring with the PLC tag table 445
13.4.5 Monitoring of data tags 446
13.4.6 Testing with watch tables 447
13.4.7 Monitoring tags using watch tables 449
13.4.8 Modifying tags using watch tables 450
13.4.9 Enable peripheral outputs and "Modify now" 451
13.4.10 Forcing tags 452

14 Distributed I/O 455
14.1 Introduction, overview 455
14.2 PROFINET IO 456
14.2.1 PROFINET IO components 456
14.2.2 Addresses with PROFINET IO 457
14.2.3 Configuring PROFINET IO 459
14.2.4 Real-time communication with PROFINET IO 461
14.3 PROFIBUS DP 462
14.3.1 PROFIBUS DP components 462
14.3.2 Addresses with PROFIBUS DP 465
14.3.3 Configuring PROFIBUS DP 467
14.3.4 System functions for PROFINET IO and PROFIBUS DP 470
14.4 Actuator/sensor interface 473
14.4.1 Components of actuator/sensor interface 473
14.4.2 Configuring an AS-i master CM 1243-2 475
14.4.3 Configuring an AS-Interface 476
14.4.4 Interface to user program 477
14.5 Communication via Modbus 477
14.5.1 Modbus RTU 477
14.5.2 Modbus TCP 480

15 Communication 482
15.1 Overview 482
15.2 Open user communication 484
15.2.1 Basics 484
15.2.2 Open user communication with TCP and ISO-on-TCP 485
15.2.3 Open user communication with the UDP protocol 487
15.2.4 Communication functions for open user communication 489
15.2.5 Configuring open user communication 493

15.2.6 Configuring a PN interface with T_CONFIG 495
15.3 S7 communication 496
15.3.1 Basics 496
15.3.2 Data structure for one-way data exchange 496
15.3.3 Communication functions for one-way data exchange 497
15.3.4 Configuring S7 communication 498
15.4 Point-to-point communication 499
15.4.1 Introduction to point-to-point communication 499
15.4.2 Configuring the CM 1241 communication module 500
15.4.3 Point-to-point communication functions 501
15.4.4 USS protocol for drives 504

16 Visualization 507
16.1 Introduction to visualization 507
16.1.1 Overview of HMI Panels in STEP 7 Basic 508
16.1.2 Creating a project with an HMI station 510
16.1.3 Cross-references for HMI objects 512
16.2 Creating HMI tags and area pointers 513
16.2.1 Introduction to HMI tags 513
16.2.2 Creating an HMI tag 514
16.2.3 Creating an area pointer 515
16.3 Configuring process screens 517
16.3.1 Introduction to configuring process screens 517
16.3.2 Working window for process screens 518
16.3.3 Working with screen layers 519
16.3.4 Working with templates 519
16.3.5 Working with function keys 520
16.3.6 Creating a new screen 521
16.3.7 Configuring a screen change 522
16.3.8 Working with objects in process screens 522
16.3.9 Changing screen objects during runtime 524
16.3.10 Basic objects for screen configuration 524
16.4 HMI functions 525
16.4.1 Input and display of process values 525
16.4.2 Working with alarms 528
16.4.3 Working with recipes 535
16.4.4 Working with the user administration 539
16.5 Completing HMI configuration 542
16.5.1 Compiling the HMI configuration (Consistency test) 542
16.5.2 Simulation of HMI configuration 542
16.5.3 Downloading configuration to the HMI station 543
16.5.4 Maintenance of the HMI station 546

17 Appendix 548
17.1 Integral and technological functions 548
17.1.1 High-speed counter (HSC) 548
17.1.2 Pulse generator 554
17.1.3 Technology objects for motion control 557

17.1.4 Technology objects for PID control 561
17.2 Telephone network connections with TeleService 564
17.3 Telecontrol with CP 1242-7 565
17.4 Web server 567
17.4.1 Enable web server 567
17.4.2 Reading out web information 567
17.4.3 Standard web pages 567
17.5 Data logging 569
17.5.1 Introduction 569
17.5.2 Using data logging 569
17.5.3 Functions for data logging 570

Index 572